GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN
(GFCM)

WORKING GROUP ON SMALL PELAGIC SPECIES
Kavala, Greece, 27-30 March 2001

OPENING OF THE MEETING

1. The second meeting of the SAC Working Group on Small Pelagic Species of GFCM was held in Nea Peramos, Kavala from 27 to 30 March 2001.

2. Twenty-three scientists from seven countries attended this meeting. The list of the participants is attached as Appendix A.

3. The Agenda of the Working Group was adopted (Appendix B) and the list of documents was updated. The final list is attached as Appendix C.

4. Mr. A. Kallianiotis (NAGREF-FRI) chaired the Session. Mr. I. Batjakas (NAGREF-FRI). was designated Rapporteur .

PRESENTATIONS TO AND DISCUSSIONS BY THE WORKING GROUP

5. Seventeen technical papers were presented and discussed by the Working Group.

6. These documents covered totally or partially 7 Management Units (MUs) and five species.

7. Three types of documents were presented: (i) assessment documents, (ii) methodology documents, and (iii) assessment related documents. The conclusions and recommendations adopted by the Working Group and referring to assessment presented in each document are as follows:

8. One document on X was sent to the Working Group who noted that the conclusion of such a document had been already reviewed at its First Session.

ASSESSMENT DOCUMENTS

9. Ten documents of this type were reviewed. The documents are referred to by numbers (See Appendix C) by the FAO code of the species, by the number of the management unit and the year of presentation (the date indicated after the scientific name of the species refers to the period of the study). Such references should be used when completing the standard forms adopted by the last session of the Working Group.

10. Forms D, Z, concerning the synthesis of the assessments and the abstracts of the working papers were discussed.

Document n^{o} 1. ANC+SAR_ 16 _01 *Engraulis encrasicolus* + *Sardina pilchardus* 1998, 2000.

11. The biomass evaluations of anchovy stock in the management unit 16 (South of Sicily) obtained by applying acoustic methods in summer 1998 and 2000 produced consistent results compared to the commercial abundance indices based on data collected at Sciecca the main base port in the study for the small pelagic landings. Observed consistency extends also to the available anchovy DEPM evaluations carried out in 1998 and 1999. Preliminary analyses of the age structure of local anchovy population indicate

the importance of recruitment for the yearly stock levels and accounts for the high inter-annual fluctuations in the catches. Further studies were still required to evaluate the state of exploitation of this resources.

Document nº 3. ANC_ 01 _01 *Engraulis encrasicolus* 1990-2000.

Document nº 8. SAR_ 01 _01 *Sardina pilchardus* 1990-2000.

12. The forms do not include formal stock assessments, but actually available basic data. Several acoustic surveys have been performed during the last decade, but due to the special characteristics of this area (very narrow shelf) information needs to be re-analysed in depth before presenting the results on biomass evolution. Catch and effort data from 1990 onwards, obtained from IEO port sampling network, would permit in theory to apply global models for stocks evaluation; but some uncertainties related to the reliability of effective effort estimations, due to observed differences in spatial distribution of sardine and anchovy stocks, discards etc, prevented up to now the use of this models. The implementation of an on board sampling program starting this year will provide complementary data which will permit to improve the effective effort estimations. In any case, both the low level of landings and acoustic surveys indicate that anchovy stock remain depleted after the 80's collapse, so the fishing pressure on this stock must be reduced. Sardine landings show also a clear decreasing trend between 1997 2000 and the same recommendation would be applicable. In parallel, environmental influence on stocks fluctuations and the ecological implications (for example, increase of other non commercial species as Capros aper) of such a fluctuations must be studied.

Document nº 4. ANC_ 06_01 *Engraulis encrasicolus* 1990-2000.

Document nº 7. SAR_ 06 _01 *Sardina pilchardus* 1990-2000.

13. Despite no data on CPUE evolution neither recent length sampling data are not still available, preventing the use of global or analytical models, some ideas on stock state can be drawn from catch data tacking into account that fleet capacity and activity has remained more or less stable over this period. So, anchovy landings show a consistent decreasing trend from 1995 up to now. Acoustic data, despite they seems to present some weakness, indicates also that recruitment have been low the last years. Then, further restrictions of fishing effort must be considered. For sardine, acoustic surveys show a consistent decreasing trend from 1992 up to now, suggesting a situation of overexploitation, despite landings remain stable. Since this phenomenon of apparent stock equilibrium when the actual situation is one of stock declining is well known for pelagic species, the stock evolution must be monitored carefully and possible further effort reductions considered. Further investigations on the effect of environmental fluctuation on the biomass of these resources should be encouraged.

Document nº 5. ANC_ 17 _01 *Engraulis encrasicolus* 1975-1996.

14. The estimated stock biomass showed a strong fluctuation in the period 1975-1996. The stock collapsed in 1987. Although overfishing is thought not to be the primary cause of the anchovy collapse of 1987, it remains true that the levels of recruitment following the 1987 have not yet reached the previous higher levels. Given this situation and considering also the current levels of catches (25% of biomass) and the decrease of the biomass in 1996, it is recommended to maintain the current level of fishing effort. CPUE data updated to 1999 show a trend of stock abundance similar to the previuos years. Market investigations are recommended to increase the human consumption of sardine to reduce both the discards of sardine at sea and the fishing pressure on the anchovy.

Document nº 6. SAR_17 _01 *Sardina pilchardus* 1975-1999.

15. The stock assessment corrected with estimates of historical discards indicates that the mid-year sardine stock biomass rose steadily from around 400,000 tons in 1975 to a peak of around 950,000 tons in 1984. After that, the biomass declined steadily, with current levels being around 300,000 tons. Current catches are around 20,000 tons, down from the peak levels of 80,000 tons in the first half of the 1980s. Due to scarcity fish market demand, discards of sardine at sea may occur. Monitoring of sardine discards at sea it is recommended. Market investigations to increase the human consumption of sardine, to diminish discards at sea and to increase catches are also recommended.

Document n° 9. SRD_ 04_01 *Sardinella aurita* 1994 -1998.

16. The paper did not present an assesment of the species as per se. However, the data and information provided may be useful for the direct and indirect evaluation methods of this species. The paper analysed the biological parameters (reproduction and growth) of the round sardinelle wich is considered of high importance to the commercial tunisian fisheries, in the transition area of the two management units 12 and 13. According to the present knowledge of the stocks of this species in Tunisia, it would be premature to give information about the state of this ressource. There are some doubts on the unicity of the stocks. Further studies are still required to clarify the issue.

Document n° 10. TRA+BOO_ 22 _01 *Trachurus trachurus* + *Boops boops* 1998-2000.

17. Trachurus trachurus. The Central Aegean stock of Trachurus trachurus has been assessed during the years 1998 – 2000. The results show that this stock is fully exploited to slightly overexploited depended on the actual value of the natural mortality. Because abundance index estimated during the previous years (1988 -1995) from landings was found to be normally distributed, the WG recommends keeping the fishing effort at the current level. On the other hand, because:

1. *T. mediterraneus* is also commercial of even higher price than that of *T. trachurus*, and
2. *T. mediterraneus* as a more migratory species in relation with *T. trachurus*, can be considered possibly as a shaved stock, the assessment of the state of stock of this species was also encouraged by the W.G.

Boops boops. The Central Aegean stock of Boops boops has been assessed during the years 1998 – 2000. the results show that this stock is fully exploited to slightly overexploited. Given that this species is being caught besides trawlers (the sampling gear) by beach seiners and purse - seiners as well, the results can be considered preliminary. Thus the W.G recommends keeping the fishing effort at the current level until multi – gear assessments; works to be done.

Document n° 15.

18. Results of a two years (1998-1999) EU funded study were presented for MU 20 and 22. Biomass was estimated using the Daily Egg Production Method, Acoustic method and Length-based VPA. Estimates ranged from 12000 to 14000 tons. Mitochondrial DNA analysis revealed the existence of different stocks in the Aegean and Ionian Seas, i.e. in MU as 20 and 22. Anchovy quantities appearing in auction sites do not reflect local production. In the big market of Piraeus, fish from different areas (e.g. Ionian Sea, or even North Aegean Sea), i.e. fish belonging to genetically different stocks, may be landed. This poses serious problems from the management point of view. It is recommended that a shift of the banned period for purse seines from December-March to September-October (during the recruitment period) will reduce the fishing effort on small individuals. A preliminary analysis of CPUE trends in purse seine fishery during the last five years, showed that CPUE is significantly decreasing in all Greek Seas, whereas fishing effort has been remained steady. It is recommended that measures, such as a reduction in fishing effort, should be taken.

Document nº 16

19. The Virtual Population Analysis applied to the stock of sardine in the central area of the Algerian coast, situated between Tenes cape to the west and Azeffoun to the east, shown that the mean age (1.87 years) and the mean size of the catch (14.26 cm) were greater than the critical age (1.49 years) and the critical size (13.25 cm) which were in turn greater than the female first maturity size (12.6 cm). Furthermore, the total balanced biomass was evaluated to be 16,668 tons; finally the present yield per recruit (Y/R=10.46 gr for F=1.37 year –1) is inferior than the optimal yield (Y/R=10.52 gr F=1.1 year –1). That was reflected on the overfishing status (E=0.74).

METHODOLOGY DOCUMENTS

Document nº 11.

20. A review of the application of the Daily Egg Production Method (DEPM) in the Mediterranean was presented at the meeting. The DEPM has been applied to the anchovy stocks of the Western basin (Catalan sea, Gulf of Lions, Ligurian Sea) in 1990, 1993 and 1994, Central basin (south Adriatic and Sicilian channel) in 1994, 1998, 1999 and 2000 and Eastern basin (Aegean and Ionian seas) in 1993, 1995 and 1999. In some cases simultaneous evaluations by acoustics have also been made showing a good agreement between the results. In general, parameters of the DEPM (daily egg production and adult parameters) show high variability both within and between regions. A good relationship between the size of the spawning area and the biomass estimate was observed. The lowest estimate of spawning biomass was made in the Sicilian channel (management unit 16) during 1999. The highest biomass values were obtained in the Catalan sea and Gulf of Lions and in the northern Aegean Sea (management units 6, 7 and 22), where anchovy is one of the most important resources (25-40% of the total fishery catches). From the review of the different DEPM analyses, it arose that DEPM application in the Mediterranean need methodological adjustments to account for the specific characteristics of the Mediterranean (high temperatures, intense stratification, increased fish patchiness etc). The Group stresses the need to organise a workshop to discuss these aspects and improve methodologies. The DEPM method is considered one of the most reliable methods of estimating biomass and monitor trends in the abundance of small pelagic fishes. It can be used to tune indirect assessment methods and provide new insights into the reproductive biology and recruitment variability of small pelagic species. The Working Group recommends that such methods be included in the assessment programs.

Document nº 12

21. Echo-integration methodology to evaluate small pelagic stocks is used annually since 1993 in the gulf of the Lion, in order to estimate the importance and the variations of resources in anchovy, sardine and other commercial pelagic species. The methodology is exposed. Spatial limits of the prospected area are analyzed, as well as according to geographical limits of the stock at East and South of the gulf of the Lion, than of the extension of transects at coast or offshore. Temporal aspects at different scales is also tackled as well as the importance of the identification trawling operations in the methodology. Biomass estimates obtained are finally discussed and future programs to remedy to certain lack of the methodology and ensure better estimates are proposed in conclusion. New tools used by IFREMER were presented. Important points when carrying out an echo-survey were presented and discussed:

Spatial aspect: Delimitation of the total area to be covered by prospecting operation has to be carried out in order to evaluate the entire biomass of the stock studied, particularly coastal area and shallow waters, break of continental shelf and general geographical limits.

Temporal aspect: Choice of survey date is a function of objectives. Environmental context has to be note and studies on way and time of doing a transect have to be completed.

Importance of trawling operation for assessment accuracy: Choice of type of gear, time of doing a haul, number and distribution of hauls by zone are very important to improve accuracy of biomass estimation. Pre-prospecting a transect would be useful.

Estimations and comparisons with professional catches: Concordance or discordance between biomass obtained from echo-survey and catches or CPUEs have to be analysed to improve accuracy of biomass estimation or to detect anomalies as well in acoustic methodology or in fisheries strategies.

Research that could help for a better understanding of pelagic aggregation in order to accurate our biomass estimation have to be done with a priority to shallow waters assessment and analyse of aggregations and school structure according to environmental factors or fishing exploitation.

A workshop on acoustic methodology in Mediterranean Sea could be held under CFCM organisation in order to discuss the above points and to find a way of standardising methodology and strategies. The Working Group reviewed the use of this methodology in the assessment progress .

More detailed recommendations are presented as Appendix to this report.

RELATED DOCUMENTS

Document n° 14.

22. The target of this study is the collection and concentration of the existing data on the anchovy fisheries, and their presentation in a form that is easily understood by the decision makers in order to correctly manage the anchovy stock. The data we used were collected in the main landing ports and include interviews, fish market records and records of the National Agency of Statistics. From those it seems that purse-seine, bottom-trawler and beach-seine are the fishing gear responsible for anchovy catches in the Greek waters. The major fishing grounds for anchovy are in the North Aegean and Thracian Sea. There is a deep concern from the fishermen, fisheries officials and people from the fish-processing industry regarding the status of the stock with reports of decrease in the sizes and quantities of anchovy that have been taken recently. The existing laws as well as their enforcement are inadequate and additional measures needed in order to protect the anchovy stock and increase the average size of the caught fish. We believe that, in order to achieve sustainable fisheries and save the Greek purse-seine fleet in a still growing anchovy market, we need to address all these problems and concerns regarding the anchovy fishery.

Document n° 17.

23. The study aims to evaluate the catches of purse seine fleet of Kavala fishing port, North Greece. Landings and deck sampling records were used for the calculation of catch per unit effort (CPUE) and the length frequencies of species caught. The main fishing grounds and the fleet behaviour according to the market price were recorded for the period March 2000 – December 2000. Sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) contributed to the 69% and 19% in the total catches respectively. The landings of sardine were regulated by the market price and it was the only considerable discarded species. Anchovy catches were mainly regulated from the sizes demand, where the public and the canning industry were interest for lengths above 120 mm. According to the species length frequencies the most frequent classes, in total length, were for sardine 130-140 mm (35.2 %) and 140-150 mm (40.7 %); anchovy 120-130 mm (29.6 %) and 130-140 mm (43.5 %). The mean catches in metric tonnes per boat per day were calculated to be for sardine 2.56, for 95 % confidence limits the mean CPUE value ranges between 1.91 and 3.21; for anchovy 0.82, for 95 % confidence limits between 0.62 and 1.02.

Document n^o 18.

24. Sardine net is a small purse seine net (250 m long, 30 m height, mesh size of 9 to 11 mm) which was traditionally used for the fishery of sardine Sardina pilchardus and gilt sardine Sardinella aurita and was banned in 1999. A pilot project was conducted in the Gulf of Kavala to assess the dynamics of the gear and its potential future use through the records of the monthly catches and biological sampling. The catch of sardine net mainly consists of sardine (around 89 %) and gilt sardine (10.5 %) with less than 0.5 % by catch. The proportion of sardines caught in the sardine net is very small compared to the total catch of sardines landed in Kavala landing port (6.7-9.3 %).

Document n^o 19.

25. A summarized overview on the state of studies on small pelagic carried out by the IEO, describing the available basic data, as well as the existing and envisaged port sampling network, was presented. Main results of acoustic surveys series performed along the entire Spanish Mediterranean coasts from 1990 up to now were also provided (Annex X).

GENERAL CONCLUSIONS AND RECOMMENDATIONS

26. As a result of the discussions and reviews of the documents made available to it, the Working Group agreed on the following conclusions and recommendations:

a) Distribute copies of the documents or send them to everybody in electronic format before the meeting.

b) In the future, priority should be given to papers dealing with shared stocks and priority species of regional or sub-regional concerns.

c) The classic VPA method should be used in stock assessment, when long data series are available.

c)bis. Direct method to assess pelagic stocks as DEPM and acoustic should be also used.

d) If a new method is used, the document should be accompanied with a brief description of this new method.

e) Some papers presented in this meeting were not assessment papers and thus could not be properly used for management purposes.

f) Synthetic analyses of the state of small pelagic species, for which a large amount of information is available, and which were considered as priority by GFCM, should be carried out. That could be achieved by some ad hoc groups that would meet during the Session of the Working Group and report to it.

f)bis. An *ad hoc* Working Group should also meet to establish a common criteria for age-reading in the GFCM area.

g) The Working Group regretted the absence of experts from the Eastern Mediterranean, Southern Mediterranean and the Black Sea region and called on these countries to make an effort to send scientist to the Working Group session. Only one representative attended from Tunisia.

h) The absence of scientists from these areas may be due to 4 major reasons:

1) Absence in some countries of national research programs that could provide information to the working groups.
2) Difficulties for scientists from these countries to obtain entry visa to the hosting country particularly when the meeting takes place in the European Union countries. The W.G. should suggest to the Commission to look into this issue and to recommend measures to overcome this problem.
3) Financial difficulties faced by scientists to cover their travel costs.
4) High number of meetings that are decided by the Commission request the frequent absence of scientists from their institutions and increases the costs for their governments. The Working Group called on GFCM to find a solution to this problem.

i) The working group noted with satisfaction the start of the new ADRIAMED project financed by Italy and covering the Adriatic Sea region. It was also informed that a new project covering the central Mediterranean has been finalized and presented for approval to countries. The Working Group however expressed the wish to be involved in one way or another in the formation process of such projects.

j) The list of main target species was reexamined. Uncertainties on the importance of the existing targeted species have been discussed and propositions for the addition of new species have been put forward. The working group intends to address a request to the SAC committee in order to produce priority criteria for the completion of the species list. Such criteria like the commercial value, the percentage in catch and the shared character of the species may be considered.

k) In relation with the standard forms or the way the way the stock assessment forms are presented in general, the working group recommended the following:
- Brief working paper should be presented analyzing the methodologies and the results estimated including relative figures or tables. The working paper should be joined with the standard forms filled.
- The standard forms need in many cases a more detailed clarification for each one sheet included in the forms. Some footnotes following each sheet could be appropriate for better completion of the forms.

DATE AND PLACE OF THE NEXT MEETING

27. The next meeting will be held in March 2002 at the Istituto di Ricerche Sulla Pesca Maritima in Ancona, Italy.

APPENDIX C

LIST OF DOCUMENTS

1	Patti B. *et al*	Italy	Echo-survey estimates and distribution of anchovy and sardine populations in the strait of Sicily: a comparison between 1998 and 2000 results
2	Sinovcic G.	Croatia	Stock assessment of anchovy and Sardine in the Adriatic Sea
3	Giraldez A. & Allemany F.	Spain	Stock assessment of *Engraulis encrasicolus* in Northern Alboran Sea
4	Giraldez A. & Allemany F.	Spain	Stock assessment of *Engraulis encrasicolus* in Northern Spain
5	Santojanni A. *et al*	Italy	Stock assessments of anchovy (*Engraulis encrasicolus*, L.) in the northern and central Adriatic Sea, in the period 1975-1996
6	Cingolani, E. *et al*	Italy	Stock assessments of sardine (*Sardina pilchardus*, Walb.) in the northern and central Adriatic Sea, in the period 1975-1999
7	Giraldez A. & Allemany F.	Spain	Stock assessment of *Sardina pilchardus* in Northern Spain
8	Giraldez A. & Allemany F.	Spain	Stock assessment of *Sardina pilchardus* in Northern Alboran Sea
9	Adel G. *et al*	Tynisia	Parametres bilogiques de la sardinelle ronde (*Sardinella aurita* Valenciennes, 1847) dans la region du Cap Bpn (canal siculo-tunisien)
10	Karlou-Riga C. & N. Vrantzas	Greece	Assessment of the state of the stocks for *Trachurus trachurus* and *Boops boops* in the Saronikos Gulf and the Cyclades islands
11	Palomera I.	Spain	Review on DEPM method
12	Liourzou B. & Guennegan Y.	France	Review on Eco-Survey method
13	Quintanilla L.F. & Garcia A.	Spain	1999 Sicilian Channel Anchovy Daily Egg Production Spawning Biomass
14	Batjakas I. & Kallianiotis A.	Greece	Some notes on the status of the Anchovy Fishery in the Greek waters
15	Somarakis S. *et al*	Greece	Abstracts of Current IMBC projects relevant to small pelagic stock assessment in Greece
16	Bouaziz A. *et al*	Algeria	Sur l'etude de la biomasse du stock exploite de la sardine (*Sardina pilchardus)* pechee par les senneurs, dans la region centre de la cote algerienne
17	Vidoris P. *et al*	Greece	Purse seine catches in Kavala fishing port
18	Koutrakis E. *et al*	Greece	Small pelagic fishery using a Sardine net in the Gulf of Kavala (Northern Aegean Sea)
19	Giraldez A.	Spain	Overview of the studies on small pelagic in Spanish Mediterranean

APPENDIX XX

IMPORTANT POINTS WHEN CARRYING OUT AN ECHO-SURVEY

Spatial aspect

Delimitation of the total area to be covered by prospecting operation has to be carried out in order to evaluate the entire biomass of the stock studied.

- Coastal area and shallow waters
- *Coastal zone is not covered by the actual strategy. This could represent a large of biomass, especially for juvenile part of the stock. Other means than usual one's have to be studied and developed.*
- Break of continental shelf
- *Depending on season, target species and final objective, offshore extension of schools has to be studied. If the extension is wide, other prospecting period has to be chosen.*
- Geographical limits
- *Geographical limits have to be tested by additional transects on the two sides of the initial area covered.*

Temporal aspect

Choice of survey date is a function of objectives (adult biomass or recruitment).

- *For recruitment purposes, dates have to be chosen when the maximum juvenile fraction of the targeted species is accessible to the boat(s).*

Survey reproductibility

- *Because of programming schedule for research vessel, it is important to note the environmental context of any survey.*

Way and time of the day for transect prospecting

- *Research has to be completed to examine influence of time of the day and direction of perpendicular transects to the coast on energy results, when prospecting.*

Importance of trawling operation for assessment accuracy

Trawling operation on one structure

- *type of gear have to be chosen regarding to the location of schools in the water column.*
- *In order to verify the following points, experiments have to be carried out to see if :*
- *hauls have to be done during prospecting time*
- *hauls have to be done during day time*
- *more than one haul have to be done for a better representation of length structure, if one structure persists along a transect,*

Number and distribution of hauls by zone

- *number of hauls have to be numerous in each homogeneous zone*
- *pre-prospecting a transect the day before could be useful for positioning hauls along the transect while executing real prospecting operation*
- *as prospecting time has to be shorter as possible, hauls could be done by a professional boat, with scientists on board*

Estimations and comparisons with professional catches

Concordance or discordance between biomass obtained from echo-survey and catches or CPUEs have to be analysed to improve accuracy of biomass estimation or to detect anomalies as well in acoustic methodology or in fisheries strategies

Biomass calculation method

- *For some species a special processing of data is necessary, regarding to bias in hauls*

Production dynamics

- *To understand discrepancies between biomass estimation and catches, it is necessary to take into account the influence of fishing market that drive all the production of pelagic fishes*

Research that could help for a better understanding of pelagic aggregation in order to accurate our biomass estimation

- *Shallow waters assessment*
- *Use of lateral sonar in open sea to quantify sub surface schools when present during transects*
- *Analyse of aggregations and school structure*
- *Influence of time of the day on echo-integration results*
- *Analyse of coastal structure according to wind direction*
- *Influence of fishing exploitation on school structure*

Workshop on acoustic methodology in Mediterranean sea

- *A workshop on acoustic methodology in Mediterranean sea could be held under CFCM organisation in order to discuss the above points and to find a way of standardising methodology and strategies.*

APPENDIX X

1. OVERVIEW OF THE STUDIES ON SMALL PELAGIC IN SPANISH MEDITERRANEAN

2. FISHERIES DATA COMPILATION

Official landings and fleet statistics (1)

- Annual (monthly) landings by port and species, from 1945 onwards

- Annual fleet census, including n º of vessels, length, GRT and crew, by port (more sparse data from 1986 onwards)

(1) *A working paper on this topic was presented at the first Small Pelagic SAC WG. The analysis of historical series of landings data showed important fluctuations, as well as different trends in the three considered subareas. Some of the fluctuations and differences among areas could be attributed to fleet or market evolution (i.e. increase of anchovy landings in Tramontana region from the sixties onwards); but others seems to correspond to environmental factors (i.e. collapse of anchovy populations in Alboran Sea in the 80's), despite fishing pressure could play also an important role*

IEO sampling network (2)

- 12 ports (covering aprox 70% of total small pelagic landings) sampled from the late 80's up to now (shorter period in three cases), taking monthly or daily catch and effort data by boat and species
- Biological sampling (length frequency distributions) of anchovy (3 ports) and sardine (2 ports) in northern area, from 85, 94 and 95 up to now respectively, on board sampling starting in 2001 in some ports of Alboran sea.

Marbella			XO	XO	XO	XO	XO	XO	XO							
Estepona					RA	RA			XO							
Santa Pola		XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO
Alicante		XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO
Roses					X	X	X	X	X	X	X	X	XO	XO	XO	XO
Barcelona					XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO	XO
Tarragona																
Castellón					X	XW	XW	XW	XW	XW	XW	XW	XW	XW	XW	XW

X: monthly landings by boat and number of positive days by month per species.
O: daily landings by boat and species
W: daily landings of sardine and anchovy of the whole fleet, with mean prices

Biological sampling

PORTS	89	90	91	92	93	94	95	96	97	98	99	00
Roses							A	A	A	A	A	A
Barcelona						SA	SA	SA	SA	SA	SA	SA
Tarragona												
Castellón	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA

Length distributions, around 4 samples month
S: Sardine- A:Anchovy

3. ASSESSMENT

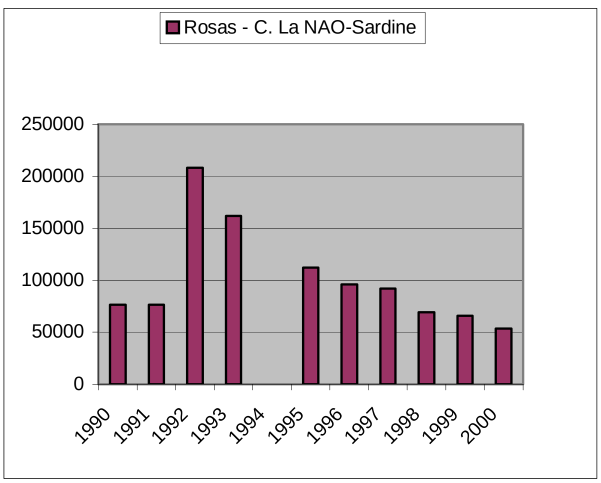
Direct methods (3)

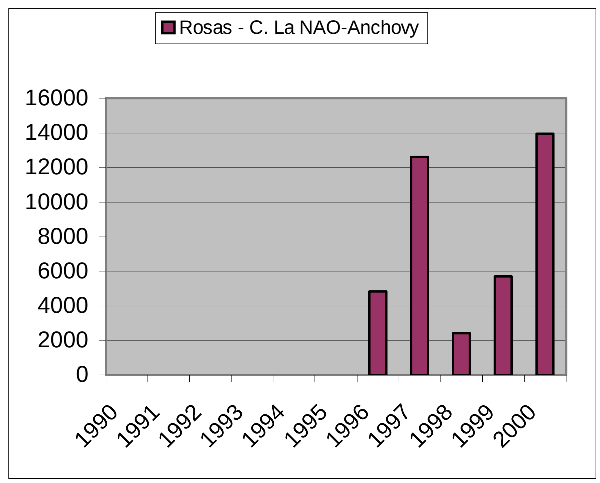
- Acoustic surveys along all Spanish Mediterranean coast (including Gulf of Lions some years) from 1982 up to now, applying the same methodology from 1990 onwards

- Egg production method used for estimating anchovy spawning stock in northern area

Indirect methods

- Nor analytical neither global models applied during the last decade; but it is envisaged to perform this kind of evaluations when reliable length frequency and CPUE data be available from sampling network
  (3)Following graphics show some relevant results of acoustic surveys in management unit 6 (northern Spain)



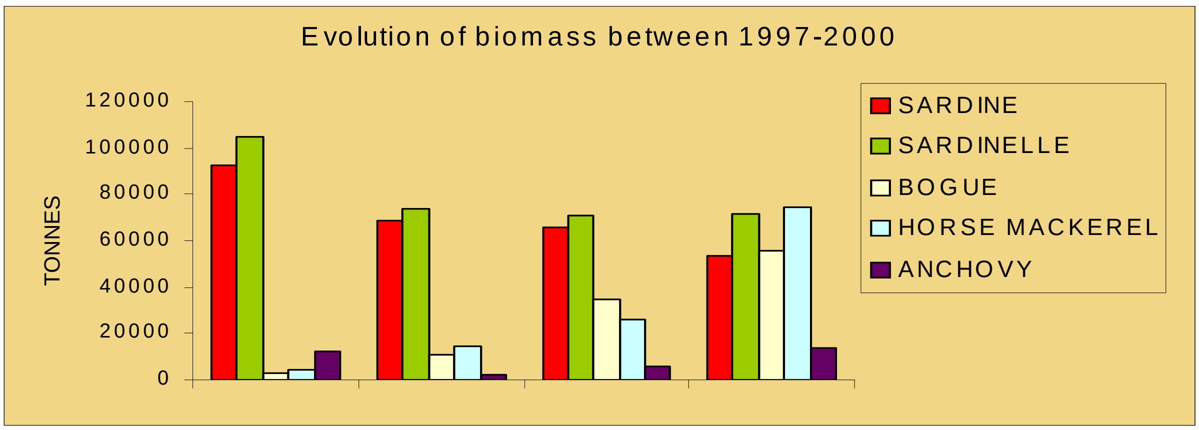


Sardine stock age structure (thousands of individuals)									
Year	90	91	92	93	95	96	97	98	99
Age									
0	3788	8453	7261	2155	5119	3734	4842	3000	5649
1	1109	527	4047	3407	1407	1059	1189	980	756
2	155	21	607	1748	161	331	70	360	366
3+	39	6	236	322	56	361	78	142	303

4. PERSPECTIVES FOR FUTURE

- It is envisaged the continuity of acoustic surveys, covering the entire Spanish Mediterranean coast
- IEO port sampling network will be integrated in the national program (Council Regulation)
- Regular evaluations using indirect methods will be performed at national level
- Evaluations of shared stocks in Gulf of Lions and Alboran Sea could be carried out in collaboration with Sète IFREMER and Nador INRH labs respectively

Possibilities of applying current methodologies for the analysis of the influence of environment on small pelagic stocks in Mediterranean Sea will be explored.



(Karlou)

SAC GFCM. Subcommittee of Stock Assessment		Assessment form Sheet D Diagnosis

Trachurus trachurus	Code	
	Page	

Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	value[1]	value[2]	trend	Comments
B_{now}				
SSB				
B_{virgin}				
F_{now}	0.76-1.12	0.37-0.73		
F_{msy}	0.88-0.98	0.65-0.76		
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}				
MSY				
MBAL				
E_{max}/E_{cur}	0.79-1.29	0.88-2.1		

1: Saronikos Gulf
2: Cyclades islands

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Fully exploited to slightly overexploited

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Because data of one year only for each area studied were used for the assessment, the result of the state of stock is just preliminary.

Risks

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Trachurus trachurus	Code	
	Page	

Management objectives

Management recommendations

Area closures	
Temporal closures	
Effort limitation	Keep the fishing effort at the current level
Minimum size	
Technical steps concerning gear	
Quotas	
Market	

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Boops boops	Code	
	Page	

Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	value[1]	value[2]	trend	Comments
B_{now}				
SSB				
B_{virgin}				
F_{now}	1.50	1.19		
F_{msy}	1.33	1.09		
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}				
MSY				
MBAL				
E_{max}/E_{cur}	0.88	0.91		

1: Saronikos Gulf
2: Cyclades islands

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Fully exploited to slightly overexploited

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Because:
1)growth parameters were taken from the literature,
2)the species is considerably caught by beach seiners as well,
3)data of one year only for each area studied were used for the assessment,
the result of the state of stock is just preliminary.

Risks

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Boops boops	Code	
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Management objectives

Management recommendations

Area closures	
Temporal closures	
Effort limitation	Keep the fishing effort at the current level
Minimum size	
Technical steps concerning gear	
Quotas	
Market	

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Gulf of Lion – 37.1.2.e	Code	Engr enc
	Page	

Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	value	units	trend	Comments
B_{now}	51000	MT	increase	Period average 1997-99
SSB				
B_{virgin}				
F_{now}				
F_{msy}				
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}	6600	MT	stable	Period average 1998-2000
MSY				
MBAL				

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Moderated exploited

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Shared stock with North of Spain

Risks

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Gulf of Lion – 37.1.2.e	Code	Engr enc
	Page	

Management objectives

Production is regulated by fishing market. When market price is low, pelagic trawl move there activities toward demersal ressources, which one's are overexploited.

Management recommendations

Area closures	
Temporal closures	
Effort limitation	
Minimum size	
Technical steps concerning gear	
Quotas	
Market	
	With the aim of managing anchovy stock and because it is shared with fishing boats from North of Spain, collaboration with scientist from Spain is necessary

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Gulf of Lion – 37.1.2.e	Code	Sard pil
	Page	

Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	value	units	trend	Comments
B_{now}	41000	MT	increase	Period average 1997-99
SSB				
B_{virgin}				
F_{now}				
F_{msy}				
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}	10700	MT	increase	Period average 1998-2000
MSY				
MBAL				

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Moderated exploited

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Shared stock with North of Spain

Risks

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Gulf of Lion – 37.1.2.e	Code	Sard pil
	Page	

Management objectives

Production is less regulated by fishing market than for anchovy. When market price is low, pelagic trawl move there activities toward demersal ressources, which one's are overexploited.

Management recommendations

Area closures	
Temporal closures	
Effort limitation	
Minimum size	
Technical steps concerning gear	
Quotas	
Market	
	With the aim of managing sardine stock and because it is shared with fishing boats from North of Spain, collaboration with scientist from Spain is necessary

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Sardinella aurita	Code	
	Page	

Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	value	units	trend	Comments
B_{now}	18700t	12-13-14		Estimation by eco survey method in 1998
SSB				
B_{virgin}				
F_{now}				
F_{msy}				
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}	11000t			Estimate average catch : 1984-1996
MSY				
MBAL				

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Unknown : Because the stock unit are not identified. If we consider that the allache of all the Tunisian stock is one unit we can say that this species is underexploited, however be careful.

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Risks

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Management objectives

Market strategy to increase the human consumption of round sardinelle in no coatal area of Tunisia. Reform of fishing vessels in order to increase the period of fishing activity along the year. Reform of sardine manufactories in order to increase their capacity of freezing in particular during the high landings periods : Mai to October.

Management recommendations

Area closures	
Temporal closures	
Effort limitation	
Minimum size	
Technical steps concerning gear	
Quotas	
Market	An accurate market study for small pelagic fisheries is recommended.
Stock unit	The identification of the stock unit of pelagic species is indispensable, in the south part of the Mediterranean sea, to apply the indirect methods of evaluation and to give the really state of resource exploitation.

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Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	value	units	Trend	Comments
B_{now}	288,000 t		Slightly decreasing	Mid-year biomass at sea estimated by VPA: average on the period 1997-1999. The corresponding spawning biomass is 148,000 t
SSB				
B_{virgin}				
F_{now}				
F_{msy}				
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}	24,054 t		Decreasing	Average catch on the period 1997-1999. Catch takes into account discarded sardine
MSY				
MBAL				
F_{mean}	0.18			Average on the period 1975-1999 estimated by VPA for the age interval 0-5. The 70% of values is below 0.21
F_{min}	0.11			Minimum value estimated by VPA for the age interval 0-5
F_{max}	0.29			Maximum value estimated by VPA for the age interval 0-5. It has been observed in 1981 and 1982
F_{now}	0.14			Average on the period 1997-1999 estimated by VPA for the age interval 0-5

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Underexploited

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Risks

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Management objectives

Monitoring of sardine discards at sea. Market strategies to increase the human consumption of sardine, to diminish discards at sea and to increase catches.

Management recommendations

Area closures	
Temporal closures	
Effort limitation	
Minimum size	
Technical steps concerning gear	
Quotas	
Market	An accurate market study for the small pelagic fisheries is suggested, with particular attention to the sardine.
	To implement in Adriatic sea a common programme for the collection of biological sampling and catch and effort data in the small pelagic fishery. Following this recommendation a research programme supported by FAO-ADRIAMED, entitled "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea" covering the whole Adriatic (except Montenegro which does not participate in the project) started the 1st of March 2001. This project is in line with the indications formulated in the Meeting held in Fuengirola the 1-3 March 2000 by SAC-Working Group on Small Pelagics.

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Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	Value	Units	Trend	Comments
B_{now}	103,000 t		Slightly decreasing	Mid-year biomass at sea estimated by VPA and DeLury model with recruitment index: average on the period 1994-1996. The corresponding spawning biomass is 69,000 t
SSB				
B_{virgin}				
F_{now}				
F_{msy}				
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}	22,857 t		Decreasin g	Average catch on the period 1994-1996. Discards are negligible
MSY				
MBAL				
F_{mean}	0.35			Average on the period 1975-1996 estimated by VPA for the age interval 0-3. The 77% of values is below 0.40
F_{min}	0.23			Minimum value estimated by VPA for the age interval 0-3.
F_{max}	0.91			Maximum value estimated by VPA for the age interval 0-3. It has been observed in 1985.
F_{now}	0.28			Average on the period 1994-1996 estimated by VPA for the age interval 0-3

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Fully exploited

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Risks

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Management objectives

Although overfishing is thought not to be the primary cause of the anchovy collapse of 1987, it remains true that the levels of recruitment following the 1987 have not yet risen the previous higher levels. Given this situation and considering also the current levels of catches (25% of biomass) and the decrease of the biomass in 1996, it is recommended to maintain the current level of fishing effort. Market strategies it is recommended to increase the human consumption of sardine to reduce both the discards of sardine at sea and the fishing pressure on the anchovy.

Management recommendations

Area closures	
Temporal closures	
Effort limitation	
Minimum size	
Technical steps concerning gear	
Quotas	
Market	An accurate market study for the small pelagic fisheries is suggested, with particular attention to the sardine
	To implement in Adriatic sea a common programme for the collection of biological sampling and catch and effort data in the small pelagic fishery. Following this recommendation a research programme supported by FAO-ADRIAMED, entitled "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea" covering the whole Adriatic (except Montenegro which does not participate in the project) started the 1st of March 2001. This project is in line with the indications formulated in the Meeting held in Fuengirola the 1-3 March 2000 by SAC-Working Group on Small Pelagics.